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Also reviewed were documents published by the AEC, Department of Defense agencies, contractors, and consultants, as well as proposed test programs (TEAPOT, REDWING and JULEP). The Weapons Orientation Advanced Course given at Field Command, AFSWP, was reviewed by Major Hesse, USA, and Lieutenant Ifland, USN, for content and technical accuracy.

b. Lisison with United Kingdom and Canada.

During February 1954, representatives of the United States, the United Kingdom, and Canada held a series of conferences concerning atomic weapons effects and exchange of related technical information. The AFSWP represented the Department of Defense at these conferences. The subsequent exchange of information proved beneficial to all concerned. Information received from the British was published in the form of reports by the Technical Information Service at Oak Ridge, Tennessee.

The exchange of technical information with the United Kingdom and Canada was continued throughout the year 1954. There was, with the Division, a more or less continuous review of documents received from these governments or of documents being considered for release to them.

3-8-3. Radiation Branch.

a. Participation in Weapons Tests.

(1) Operation CASTLE.

During Operation CASTLE, at the Pacific Proving Grounds, in February, March, and April 1954, Lt. Colonel E. C. LaVier, Chief of the Radiation Branch, and Dr. Herbert Scoville, Technical

Director, AFSWP, were present and witnessed some of the shots. The

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major development at Operation CASTLE in the field of radiation effects was the very extensive and heavy fall-out contamination. CASTLE shots made evident the fact that surface bursts of megaton yield would contaminate thousands of square miles at levels significant from a military standpoint. (See par. 3-8-3 d.)

(2) Planning for Operation TEAPOT.

Projects proposed by the Services for Operation TEAPOT, as well as those sponsored by the AFSWP, were revised in accordance with the anticipated weapons tests to be made and with the funds available. The concept of what would be required for thermal measurements for Operation TEAPOT was broadened and became more detailed during the first six months of the year 1954. In view of the peculiar problems to be met in instrumenting the high altitude shot and the possibility of conducting thermal measurements on devices with yields between one-tenth KT and 5 KT, the United States Naval Radiological Defense Laboratory was approached with a proposal that it expand considerably its field measurements program. (See par. 3-8-3 b(2).)

b. Studies in Thermal Radiation.

(See Vol. VI, par. 3-8-2 b.)

The results of a study of the atmospheric transmission of thermal radiation from air and surface bursts were compiled in draft form during the first half of the year 1954. Entitled "Atmospheric Transmission of Thermal Radiation from a Nuclear Detonation,"¹ by L. B. Streets, this paper presented a new approach to the problem of predicting thermal energy density versus slant range in real atmospheres. Previous methods for scaling of the thermal radiation had been based

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primarily upon visibility laws, strictly applicable only to specular transmission of radiant energy. Most targets, however, having 180° or 2π fields of view, would be exposed to radiation scattered to them by the atmosphere, in addition to the specular energy to which they would be directly exposed. In former treatments of this problem, no corrections were made to allow for energy absorbed by the water and carbon dioxide normally present in the atmosphere. This former view, because it neglected the contribution of scattered radiation and the loss of radiation by absorption, gave considerably lower predicted thermal energies at great distances corresponding to ranges of significant thermal effect from larger yield weapons, and at shorter distances in atmospheres of low visibility. The new treatment of the problem resulted in a single curve for air bursts, for predicting thermal energy densities as a function of slant range, good for all visibilities between two and fifty miles, and up to distances of half the existing visibility. Thermal energy densities, in cases of no appreciable cloud cover, were predicted to be accurate to plus or minus 30 per cent, while at ranges greater than half the existing visibility, the errors would increase progressively. During the second half of the year, the study of atmospheric transmission of thermal radiation was continued. The paper cited above was reviewed and was slightly modified. It was expected that it would be published as AFSWP-509 in January 1955. On 3 December 1954 a meeting of representatives of laboratories interested in the problem of atmospheric transmission of thermal radiation was held in AFSWP headquarters. The general problem of the parameters to be measured for practical solutions was discussed. It was learned

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that most of the current work on atmospheric attenuation was being conducted by the Air Force, and that there was apparently little activity concerning atmospheric attenuation of thermal radiation in connection with ground targets. No contractual commitments for AFSWP support of atmospheric transmission studies were made during the latter half of 1954.

The completion of the "Big Picture" study was mentioned in paragraph 3-8-2 above. Insofar as information on thermal effects was concerned, the gaps in knowledge were found to include thermal phenomena of high altitude detonations, thermal effects on missiles and aircraft in flight, the mechanism of generation of the thermal layer required for precursor formation, the thermal phenomena of medium yield surface bursts, the thermal phenomena of high yield air bursts, the effects of clouds in real atmospheres and of ground on the transmission of radiant energy, the thermal damage beneath clothing, the manner in which retinal burns vary with the characteristics of the thermal pulse, basic thermal phenomena of fractional KT detonations at all altitudes, and safe delivery criteria for new design aircraft as affected by thermal radiation.

The twelfth meeting of the Panel on Thermal Radiation (see par. 3-2-6 a), in executive session, was held at the University of Rochester, Rochester, New York, on 1 and 2 April 1954. The purpose of this meeting was to review and prepare recommendations for programs in thermal effects and thermal burns during the Fiscal Year 1955. The Panel reviewed very carefully the studies of burns beneath clothing, and recommended continued studies in that field. Such studies were

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currently supported by the AFSWP at the Naval Radiological Defense Laboratory and the Naval Material Laboratory. The Panel also recommended the continuation of the fire effects study programs at the Forest Products Laboratory and at the California Forest Range and Experiment Station. (See Vol. VI, par. 3-8-2 b.) In all, the programs of nine laboratories, three of which were concerned with thermal burn studies, were reviewed in detail by the Panel, which recommended the support, during FY 1955, of programs totaling approximately \$315,000.

The thirteenth meeting of the AFSWP Advisory Panel on Thermal Radiation was held on 28 October 1954. At this meeting the Panel reviewed past and planned programs. The minutes of the meeting and the recommendations of the Panel were approved by the Chief, AFSWP. Action on the recommendations was to be taken, subject to the availability of funds.

A Thermal Ad Hoc Committee, composed of some of the foremost medical specialists in the fields of pain, burns and psychiatry, established criteria for the prediction of combat ineffectives as a result of thermal radiation. These criteria were to be used for prediction of casualties in combat situations, and, later, in non-combat situations.

Initial steps were taken toward development of standard fabrics of a specific type and weight, but with varying reflectivities, for use in such thermal radiation laboratories as the Naval Radiological Defense Laboratory, the Naval Material Laboratory, and the laboratory at the University of Rochester. Such fabrics would be used not only for testing the fabrics themselves, but for testing burn effects beneath

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them. Standardization of fabrics would facilitate a cross-check of experimental data and results, and would provide a means of integrating the data and results of the several laboratories. Arrangements were made with the Quartermaster Research and Development Laboratory, Army, for the manufacture of a standard fabric for use in thermal radiation research.

Progress under the various AFSWP thermal radiation study contracts during the year 1954 is summarized in the following paragraphs:

(1) Naval Material Laboratory.

The polyethylene skin simulant which the Naval Material Laboratory had been studying in both the laboratory and the field in the evaluation of the protection offered by fabrics against thermal burns, was determined to be of limited usefulness. Although it had been recognized that the thermal constants for polyethylene were lacking in various desirable similarities to human skin, it had been thought that the combination of its physical constants offered promise for the purpose intended. At the insistence of the Panel on Thermal Radiation, Dr. F. C. Henriques, of Technical Operations, Incorporated, was requested to conduct a search for a material with a better match of thermal constants to those of skin. At the University of Rochester, during June 1954, representatives of the University, the Naval Material Laboratory, the AFSWP, and Dr. Henriques thoroughly reviewed the skin simulant problem. As a result of Dr. Henriques' study, a laminated phenolformaldehyde polymer called Durite was proposed as a substitute for polyethylene, and the NML group agreed to change to the use of this

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new material. It was further agreed that NML would adopt the damage-time integral instead of the maximum temperature reached, in evaluating the results of the skin simulant. During the latter half of the year 1954, little or no progress was made in the development of a skin simulant. At the October meeting of the Panel on Thermal Radiation it was recommended that several small projects be initiated in order to give the problem further study. Meanwhile, routine determination of critical thermal energies was continuing at Naval Material Laboratory.

(2) Naval Radiological Defense Laboratory.

As was mentioned above (par. 3-8-2 a(2)), the Naval Radiological Defense Laboratory (NRDL) was asked to expand considerably its participation in thermal measurements at Operation TEAPOT. Increased Service interest in the development and use of fractional KT weapons, and the emphasis upon the study of thermal emission, led to a requirement for high time resolution thermal measurements. Additional interest was shown also in obtaining rough spectral analyses of the thermal pulses as a function of time. As a result of these requirements, NRDL was asked to procure two bolometers, develop a wide band spectrometer, develop a device for measuring total thermal energy up to the first minimum, develop improved time resolution radiometers for use on the ground and in the air, and develop calorimeters with increased sensitivity. The NRDL began using, during the first half of the year 1954, the simulated field pulse from the Mitchell source for a basic study of burns beneath fabrics, using rats as indicators. Work continued at the NRDL, in a joint project with the California Forest Range and Experiment Station, on the study of the mechanism of scaling

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to high yields the ignition energies of thin materials, such as kindling fuels, and the effects of typical surfaces on the generation of heat in thin layers of air conducive to precursor formation. As of the end of the year a preliminary report had been made on thermal response of cellulose materials, and the AFSWP planned additional support for this study. In response to a request from the Office, Chief of Engineers, Army, and the Bureau of Yards and Docks, Navy, a contract was initiated with the NRDL for a survey of exterior kindling fuels in selected zone of the interior military bases, to determine the vulnerability of military bases to thermal damage in an atomic attack.

(3) Massachusetts Institute of Technology.

There was no progress to report, during the year 1954, on work being carried on at Massachusetts Institute of Technology. The research group there was continuing its studies of the time-temperature-depth of char in a two layer system. A proposal was considered to increase AFSWP support at MIT for theoretical and experimental study of heat transfer and thermal damage in certain configurations.

(4) Forest Products Laboratory.

By the middle of the year 1954 the Forest Products Laboratory had essentially completed its studies of the ignition of interior kindling fuels, using the graphite source for thermal pulses simulating those from low yield weapons. Work was begun on ignition energies for a pulse simulating that from a 10 MT weapon. Investigation was begun also into the effect of window glass interposed between the source and the target, and plans were underway for a study concerning the effect of window screening. During the latter half of the year,

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these studies were extended to include a survey of interior kindling fuels in six cities in the United States, in order to provide data for use in predicting primary fire effects from an atomic detonation over a large city. This survey was similar to the survey of exterior fuels being conducted by the California Forest Range and Experiment Station (see par. 3-8-3 b(5) below). The problem of obtaining statistics on interior kindling fuels was, however, understandably more complex than that of obtaining statistics on exterior kindling fuels. The AFSWP prepared a staff paper for the Forest Products Laboratory covering a mathematical method for calculating the probability of ignition of kindling fuel by an atomic weapon detonation.

(5) California Forest Range and Experiment Station.

At the California Forest Range and Experiment Station work was continued on extending critical ignition energy densities to the higher yield weapons. The experimental data on these energy densities were obtained by using the Mitchell source at the Naval Radiological Defense Laboratory. Preliminary summaries of results indicated that the energy densities required to produce ignition would increase with increasing yield as the one-eighth power of the weapon yield. Work was also continued on the various problems of fire behavior and the influence of meteorology on seasonal fire potential and fire behavior in forests and in built-up areas. The group at the CFRES conducted a survey of several cities of the United States, through contact with their respective fire chiefs, to determine the correlation between season and the incidence of individual fires in the cities. Representatives of CFRES and of Forest Products Laboratory (see par. 3-8-3 b(4) above)

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visited the Library of Congress to do research in literature available on the spread of conflagrations. As stated in paragraph 3-8-2 b(2) above, the joint project of the Naval Radiological Defense Laboratory and the California Forest Range and Experiment Station concerning the effect of typical surfaces on the generation of heated air layers conducive to precursor formation was continued. The investigations of heated layers would supplement studies planned for the field in Operation TEAPOT.

Operation FIRESTOP, conducted at Camp Pendleton, California, was monitored and given some financial support by the AFSWP. This operation was for the purpose of investigating mass fire potential and fire behavior in wildland areas. The field phase of the operation was completed in September 1954. Professor R. Keith Arnold of the CFRES, who was manager of the operation, made a report to Headquarters, AFSWP, in which he stated that although the assembled data had not been analyzed, some new methods of fire suppression and ignition might well come of this investigation.

(6) Technical Operations, Inc.

Under an existing contract it was expected that Technical Operations, Incorporated, would review all available data on fireball phenomena, as obtained from analysis of photography, with the objective of publishing a document which would enable the scaling from one yield to another of all data known concerning fireballs. Such data would include ultimate diameters, rates of growth, length of time to the various maximums and minimums, and a complete temperature history.

(7) Chemical and Radiological Laboratories.

The study of the attenuation of thermal radiation

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by fog and smoke was continued at the University of Michigan. This work was sponsored by the Chemical and Radiological Laboratories under contract with the AFSWP. A preliminary draft was issued, covering the theoretical studies of the six-flux method of predicting thermal radiation attenuation by smoke. Plans for future work on this project included: extension of the six-flux method to include surfaces upon which the reflection was not zero, including sand, dense vegetation, grass, and snow; calculations for the source within a smoke screen; and experimental studies in support of theoretical studies.

c. Studies in Nuclear Radiation.

(See Vol. VI, par. 3-8-2 c.)

During the early months of the year 1954, the Radiation Branch, Weapons Effects Division, was instrumental in initiating an AFSWP letter to the three Services suggesting that plans be made to the end that if and when atomic weapons were used in tactical situations in wartime, the resultant weapons effects would be fully investigated. Concurrence of the three Services was received, and staff work on the project was begun by members of the Radiation Branch in conjunction with representatives of the Operations and Training Division and the Plans Division, respectively.

The results of Project SUNSHINE, carried on by the RAND Corporation (see Vol. VI, par. 3-8-2 c.), were followed by members of the Radiation Branch. Several meetings called by the AEC in connection with this project were attended by members of the Branch. A companion project of the AEC, Project AUREOLE, was also followed by the Radiation Branch.

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During the latter half of the year 1954, a contract was given to the Naval Radiological Defense Laboratory (NRDL) for a study of the residual nuclear radiation hazard. The objective of this project was to study all available data relating to the gamma radiation hazard from surface and sub-surface nuclear detonations, in order to develop procedures for predicting gamma radiation dosages for a range of situations of military interest. In particular, an attempt was to be made to predict the influence of weapon yield, medium of detonation, and wind structure on the fall-out characteristics. This project encompassed a very complex study, and was expected to continue into FY 1956.

Progress in other AFSWP-sponsored nuclear radiation contracts is briefly stated below:

(1) Under National Bureau of Standards.

Progress continued under the contract with Dr. Fano's group at the Bureau of Standards. Monte Carlo calculations on the reflection and transmission of gamma radiation by plane parallel barriers were extended to include not only the energy spectrum, but also the angular distribution of the radiation. A code was under construction for calculating on the Standards Eastern Automatic Computer the transmission and reflection of radiation by plane parallel barriers, using a method which combined random sampling and analytical procedures. There was completed a draft of a manuscript on the calculation, by the moment method, of the diffusion of radiation from plane oblique sources. Also completed was a draft of a report on a calculation of the radiation received by partially shielded detectors, such as detectors placed in a foxhole.

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Under the contract which called for an analysis of the field measurements of residual gamma energy spectra, Drs. Wyckoff and Miller and their associates calibrated the underwater probes which were used during Operation CASTLE by the Scripps Institute of Oceanography to measure the large yield surface burst weapon fall-out which did not fall on islands and atolls. This group from the Bureau of Standards continued to consult with AFSWP personnel concerning the general problem of the field measurements of the energy spectra of the residual gamma radiation. The group also provided consultants who assisted materially in the TEAPOT planning. As of the close of the year 1954 a report, "Survey of Data on Residual Gamma Spectra" (NBS Number 10A115), had been received.

The contract with the Betatron Section of the National Bureau of Standards was delayed as a result of late delivery of necessary equipment. As of the end of the year 1954, the contracted experiments had been conducted, but no report on the results had been received.

(2) Under Nuclear Development Associates.

A contract was negotiated with the commercial firm, Nuclear Development Associates, of White Plains, New York, under which that firm was to collect, evaluate and interpret all past atomic test information, laboratory information, and theoretical information with bearing on the problem of nuclear radiation effects of atomic weapons. The results of the work by Nuclear Development Associates were to be published in a Nuclear Radiation Handbook.

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d. Studies in Residual Radiation.

On 21 April 1954 a meeting was held to determine what problems relating to the beta and soft gamma radiation hazards should be investigated during Operation TEAPOT. It was decided that the desired investigation could be broken conveniently into three general parts, as follows:

(1) The hazard to a prone man lying in a contaminated area. In this investigation, phantoms would be used, instrumented with ion chambers and some film in order to obtain depth dose measurements as well as skin hazard.

(2) The hazard to a man standing on a city street or in any area in which the reading of a gamma instrument would not indicate the beta hazard as well, because of the shielding from gamma radiation afforded by nearby walls. Phantoms and films would be used in this investigation also.

(3) The skin contact hazard to mechanics working on contaminated aircraft. This would be investigated by the use of film, an extrapolation chamber, a probe type of experimental survey meter, and possibly by the use of a "nand" phantom.

The Chief of Naval Operations requested the AFSWP to provide a scientific opinion as to the extent and amount of contamination that might be expected in the event that an aircraft carrying an Alias Betty weapon should crash when landing on an aircraft carrier. The results of a study on this problem were forwarded to CNO on 1 March 1954.

The Fourth Tripartite Instrument Conference was held in

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England during the first half of May 1954. Major John d'H. Hord of the Radiation Branch attended as the representative of the Department of Defense. Subjects discussed at this conference included reactor instrumentation for weapons effects tests, and radiac instrumentation. Meetings were held at the British Atomic Energy Installation, at Harwell, and at the Ministry of Supply in London.

On 2 June 1954 a meeting was held with the Royal Australian Air Force Mission, by the Air Force Directorate of Requirements. Major Hord, of the Radiation Branch, and Lt. Colonel Day, of the Effects Application Branch, Weapons Effects Division, attended this meeting and discussed radiation instrumentation of classification no higher than Confidential (not Restricted Data).

A study was made of the need for a new attitude toward the measurement of beta radiation as an indication of local contamination in the presence of a large ambient gamma field. The need for this type of instrumentation was indicated by the widespread contamination which resulted from the thermonuclear weapons detonated during Operation CASTLE. The conclusion reached as a result of the study was that it would probably be necessary to have a beta-only sensitive meter. Such an instrument would be of great use to personnel who could not be evacuated from a contaminated area, in which case they could test their food, water, and clothing for contamination. This matter was to be presented to representatives of the three Services at the next meeting of the Panel on Radiological Instruments. There were, however, no meetings of that panel during the year 1954. (See par. 3-2-6 b.)

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A study was made of the possibility of using cobalt or some other material in order to produce added contamination as a result of induced activity. This subject was considered by various groups, including the Weapons Systems Evaluation Group, Los Alamos Scientific Laboratory, as well as by several popular scientific authors. It was decided that, although data concerning cross-sections and temperatures were not at hand in sufficient amount to make possible a definite conclusion, the possibility still existed of using some relatively short-lived isotope, such as radio-gold, to force persons in a large contaminated area to remain within their shelters for a period which might be long enough to cause death from starvation or lack of medical aid.

3-8-4. Blast and Shock Branch.

a. Base Surge Investigation.

(See Vol. VI, par. 3-8-3 b.)

During the fiscal year 1954 the AFSWP supported the base surge investigation program of the Naval Ordnance Laboratory in the amount of \$69,700. In addition, the AFSWP supported with FY 1954 funds in the amount of \$9,400, base surge photography conducted by the Stanford Research Institute in connection with Phase II of Project MOLE at Camp Cook, California. (See Vol. VI, par. 3-8-3 b.) The work of the Naval Ordnance Laboratory included:

- (1) Analysis of the photographic records of Project MOLE (small-scale underground explosion test in different types of soil).
- (2) Preparation of a report to summarize the available data on surface phenomena from shallow underwater explosions.
- (3) Preparation of a summary report on the results

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Also in April, at the request of Rear Admiral Parker, Deputy Chief, AFSWP, Lt. Colonel Day worked out the maximum radii of 10 psi, 5 psi, 30 cal/cm², 10 cal/cm², a 600 r dose prompt gamma, and a 100 r gamma dose for a one megaton weapon, based upon current scaling laws.

In May 1954, Lt. Colonel Day prepared a chart entitled "Basic Effects Data, Megaton Weapon - Estimated Craters for Underwater Bursts in 'The Narrows', New York Harbor, and Comparative Coverage - 500 r Dosage from Fall-out to H + 50 Hours - 15 Knot Wind".

Preparation of "A Summary of the Effects of Weapons in the Megaton Range" was begun in May also. This summary was published later in the year as AFSWP-603.

At the request of Admiral Parker, in June 1954, Lt. Colonel Daughtry made a study, the results shown in charts and overlays, entitled "Effects on Naval Formations of Atomic Weapons".

3-8-7. Medical Branch.

The Medical Branch, Weapons Effects Division, was headed by the members of the Office of Surgeon, AFSWP. (See par. 3-8-15.) Late in the year 1954, a Fall-out Study Group, of which more will be said later, was added to the Medical Branch.

Projects in medical research at medical institutions and at research laboratories continued to be sponsored and followed by the Armed Forces Special Weapons Project. Contracts for such research, research accomplishments and other studies and liaison activities will be enumerated under their proper sub-headings below.

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a. Contracts for Research.

(1) On 8 February 1954, Dr. J. J. Nickson of the Sloan - Kettering Institute was awarded a contract in the amount of \$15,000 for the study of the post irradiation syndrome in humans.

(2) On 17 March 1954, the Naval Radiological Defense Laboratory was granted \$20,000 for studies concerning the effect of neutron radiation on physiological systems, with Dr. V. P. Bond heading the project.

(3) Another contract with the Naval Radiological Defense Laboratory was awarded on 18 March 1954, with Dr. Edward L. Alpen the project director. This contract, in the amount of \$40,000, was for the purpose of determining the systemic effects of high energy radiant thermal burns.

(4) A contract totaling \$21,800, covering an ionizing radiation research project, was renewed with Baylor University on 12 July 1954.

(5) On 19 July 1954 another contract was renewed. This contract with the University of Rochester covered studies in the field of the therapy of ionizing radiation, and was in the amount of \$65,000.

(6) Another contract renewal, on 12 August 1954, was with the University of Pennsylvania, in the amount of \$13,482, for studies of the effect of thermal radiation on human skin.

(7) A contract amounting to \$33,000 was renewed with the Naval Radiological Defense Laboratory on 28 October 1954, for studies concerning the effect of beam energy on the mammalian responses of pene-

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trating radiation.

(8) A contract with the National Institutes of Health for studies on the evaluation of the effectiveness of various antibiotics as therapeutic agents in radiation injury was terminated as a result of a change in policy of the contracting institution.

b. Research Accomplishments.

Results of research indicated, in the year 1954, that high doses (up to 2,000 r) of low energy (50 KVP) x-irradiation would not incapacitate, much less kill, dogs. Continued studies on whole body irradiation of humans furnished interesting data on tolerance doses and the dose required for immediate incapacitation. Studies disclosed that the relative biological effectiveness of irradiation was not as high as was formerly believed, but was of the order of 2. Incapacitation studies utilizing the tower reactor at the Oak Ridge National Laboratory tended to corroborate this figure.

c. Further Study Plans.

Emphasis in the research program continued to be directed toward ascertaining the tolerance dose for whole body irradiation in humans, as well as toward defining the biological recovery factor in the radiation syndrome. Informal arrangements were made with the School of Aviation Medicine for the study of whole body irradiation in sub-human primates. This study was being carried out at the Los Alamos Scientific Laboratory, and, beginning in July 1954, at Oak Ridge National Laboratory, where the tower reactor was used. Thermal studies were directed toward the occurrence of burns under clothing, and toward the local lesion and its sequelae. Studies of the protective qualities

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of clothing were to be continued, and it was anticipated that a laboratory experiment would be performed to determine the threshold energy required to produce chorioretinal burns.

d. Fall-out Study Group.

As a result of a directive from the Joint Chiefs of Staff, a Fall-out Study Group was instituted in Headquarters, Armed Forces Special Weapons Project. This group was organized to work in conjunction with the Medical Branch of the Weapons Effects Division. Personnel spaces were authorized, and Colonel Roy D. Maxwell, USA, who was appointed chief of the group, reported on 16 November 1954 for twenty weeks of special duty. Lieutenant H. H. Mitchell, USN, of the Analysis Branch was made available to work in the Fall-out Study Group. As of the end of the year 1954, positions remained open in the group for a physician and a physicist. It was believed that these positions would be filled early in the year 1955.

e. Other Activities.

Members of the Medical Branch took part in the program of the Panel on Thermal Radiation (see par. 3-8-3 b, above). At the April meeting the position of the AFSWP in the field of thermal research was explained. At both the April and the October meeting of the Panel, the bio-medical portion of the thermal program was thoroughly reviewed.

Nine medical officers - two Army, two Navy, four Air Force and one from the U. S. Public Health Service - were selected to participate in the AFSWP-sponsored Radiobiological Course presented at Reed College and Oak Ridge, Tennessee. The course was so revised as to condense the study at Oak Ridge and to include a period at Sandia

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Base for the purpose of attending the Weapons Orientation Course there.

Lt. Colonel Louis E. Browning of the Medical Branch was a member of the group which carried out the joint AEC-DOD-AFSWP Project 4.1 for the study of United States personnel and Marshallese natives who were inadvertently exposed to radioactive fall-out following the BRAVO shot at Operation CASTLE. Such study included hematological and dermatological evaluation, as well as investigation of internal deposition, urinary excretion and total body burden of fission products. The project was carried out at Naval Air Station, Kwajalein. A final report of Project 4.1, numbered WT 973, was published in October 1954.

Major Carl L. Hansen, Jr., USAF, was a participant in AFSWP Project 1-M-54, the purpose of which was to evaluate more completely the effects experienced by the United States personnel mentioned above. Such personnel were observed at Naval Air Station, Kwajalein, and at Tripler Army Hospital, Honolulu. Following observation, the personnel concerned were returned to full duty. A final report on the study was distributed to interested agencies.

Members of the Medical Branch participated in numerous conferences concerning research and findings in the field of medicine as applied to the effects of atomic weapons. Their work necessitated a number of trips. A great many articles on matters pertaining to their field were reviewed by members of the Branch.

3-8-8. TEAPOT Planning Group.

As explained in the previous volume of the AFSWP History (see Vol. VI, par. 3-8-1 c; 3-10-2 g.), planning for Operation TEAPOT was well under way in the year 1953. The TEAPOT Planning Group was

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